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EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT

PAPER NUMBER

1753

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8

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-8

Office Action SummaryApplication No.
09/699,897Applicant(s)
CooperExaminer
Rodney McDonaldArt Unit
1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Jan 31, 2003
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 28-33 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 28-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 4,5 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 28-33 are rejected under 35 U.S.C. 102(e) as being anticipated by Abburi et al. (U.S. Pat. 6,086,725).

Improved targets for use in DC magnetron sputtering of nickel or like ferromagnetic face-centered cubic (FCC) metals are disclosed for forming metallization films having effective edge-to-edge deposition uniformity of 5%(3 σ) or better. Such targets may be characterized as having: (a) a homogeneous texture mix that is at least 20% of a <200> texture content and less than 50% of a <111> texture content, (b) an initial pass-through flux factor (% PTF) of about 30% or greater; and © a homogeneous grain size of about 200 μ m or less. (See Abstract)

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Such improvement in target longevity and/or deposition uniformity may be obtained first by providing, in ferromagnetic targets that have a thickness of as much as 3 mm or more: an average (with per-sample point restrictions), and more preferably, a *homogeneous crystalline texture mix that is at least 20% of the <200> oriented texture*. More preferably, the texture mix should at the same time be less than about 50% of the <111> oriented texture. Even more preferably, an average, and more preferably, *a homogeneous texture mix should be provided that is at least 32% <200> texture*, while further keeping at less than about 10% the <111> oriented texture. Yet more preferably, an average, and more preferably, *a homogeneous texture mix should be provided that is at least 35% <200> texture*, while further (optionally) keeping at less than 9% the <111> oriented texture. *Yet more preferably, the latter homogeneous texture mix should further keep at less than 30% the <111> oriented texture. The remainder of the homogeneous texture mix can be of the <220> texture.* (Column 2 lines 44-62)

33
37
40
35
induce stress
43
29
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A grain size of about 150 μm or less should be provided. Even more preferably, a grain size of about 100 μm or less should be provided. (Column 3 lines 48-50)

It is known in the art that target attributes can vary as a function of: (1) the mine or other source from which metal ore is obtained; (2) the purification process used for purifying the metal ore (into high purity nickel); (3) the casting process used for melting and *recrystallizing* the purified metal; (4) the *forging* or metal working processes used for shaping the cast metal; (5) the machining processes used for giving each target its final shape; and (6) *any annealing or other* treatments applied to the target material during manufacture of the target. As such, the

heat treat

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specific identities of companies A, B and C is irrelevant because *alternative, target manufacturing processes may be used to create targets in accordance with specifications of the present invention*. Company D is identified herein simply to demonstrate at least one such company that may create targets in accordance with specifications set forth herein. (Column 12 lines 3-19)

3. Claims 28 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Cole et al. (U.S. Pat. 6,391,172).

A high purity cobalt sputter target is disclosed *which contains a face centered cubic (fcc) phase and a hexagonal close packed (hcp) phase*, wherein the value of the ratio of X-ray diffraction peak intensity, $I_{\text{fcc}}(200)/I_{\text{hcp}}(1011)$, is smaller than the value of the same ratio in a high purity cobalt material obtained by cooling fcc cobalt to room temperature from the high temperature at which it is molten. High purity cobalt is defined as having an oxygen content of not more than 500 ppm, a Ni content of not more than 200 ppm, contents of Fe, Al and Cr of not more than 50 ppm each, and Na and K of less than 0.5 ppm. *The disclosed sputter target is manufactured by subjecting the material to cold-working treatments (less than 422 °C.). Annealing the material, at a temperature in the range 300-422 °C for several hours, between cold working treatments significantly increases the amount of cold work which could be imparted into the material.* The high purity cobalt is deformed in such a way so as to cause the (0002) hcp plane to be tilted between 10-35° from the target normal. The aforementioned phase

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proportions and crystallographic texture significantly improves the sputtering efficiency and material utilization. (See Abstract)

In the case of high purity cobalt, the ratio of fcc phase to hcp phase has significant influence on the magnitude of the magnetic permeability. The fcc phase is much less anisotropic in magnetic properties than the hcp phase. Consequently, a target consisting mostly fcc phase has very low PTF, and since there are no strongly preferred crystallographic directions the flux flow is dictated by the target geometry. This geometry tends to restrain the flux within the plane of the target and inhibits flux leakage. If the amount of hcp phase in the target is increased and the easy magnetization direction $\langle 0001 \rangle$ in the hcp crystal is aligned normal to the target surface, the permeability in the plane of the target is decreased, and it is easier to generate the leakage magnetic field through the thickness of the target. If it were possible to decrease the fcc phase in the cobalt sputter target manufactured by the conventional process, and to increase its hcp phase so that the ratio of the fcc phase to the hcp phase is decreased, then the permeability in the plane of the target could be decreased, resulting in an increase in the magnetic leakage field on the surface of the target. This means that a high purity cobalt target which is thicker than the conventional cobalt can be used, resulting in longer service life and improved material utilization.

(Column 2 lines 40-62)

It is difficult in practice to obtain the ratio of fcc phase to hcp phase of cobalt by optical volume measurement. It has become common in the industry to consider a ratio of the intensity of X-ray diffraction peaks which are proportional to the volumetric ratio of the two phases. The

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peaks which are used in the ratio are the (200) in the fcc phase and the (10 11) peak in the hcp phase. These peaks were chosen because of overlap in the stronger fcc (111) and hcp (0002) diffraction peaks. (Column 2 lines 63-68; Column 3 lines 1-4)

The inventors have developed a process for manufacturing high purity cobalt sputter targets which is characterized by a ratio of the X-ray diffraction peak intensity for the fcc phase to the X-ray diffraction peak intensity for the hcp phase, which is considerably smaller than in the conventionally processed high purity cobalt sputter target. The process of this invention comprises the steps of heating conventional high purity cobalt material having a fcc single phase until it is melted, and then pouring it into a mold and allowing it to cool from the high temperature. This step can be carried out by any available melting means. However, it is preferable to use a vacuum casting method, such as a vacuum induction melting furnace, or an e-beam furnace. The resultant cast ingot is then cooled to room temperature. In the alternative, the ingot is subjected to a hot-working treatment. The ingot is then allowed to cool to room temperature, so that part of the fcc single phase is transformed into a martensite structure comprising a hcp phase. Then, in the second stage of the process of this invention, the resultant cobalt material comprising mostly a fcc phase with some hcp phase is subjected to a cold-working treatment, which preferably results in a thickness reduction of no less than 5% at a temperature less than the hcp transformation temperature (422 °C.). *As a result of the cold working, a compression strain is imparted to the cobalt material and a part of the existing fcc phase is transformed into a martensite structure comprising a hcp phase.* (Column 3 lines 5-31)

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Any of the conventional cold-rolling methods, such as rolling, drawing, swaging, forging or general press working may be used for this invention. It is preferable that the high purity cobalt is cold worked until its reduction in thickness is about 10% or more. To increase the reduction, the inventors found that intermediate anneals in the temperature range 300-422 °C for several hours allowed substantially more (40-60%) cold work to be imparted into the cobalt. Without such intermediate anneals, the cold ductility limit was found to be 20-25%. High purity cobalt manufactured in the aforementioned way can produce a significantly smaller X-ray diffraction peak intensity ratio, $I_{fcc}(200)/I_{hcp}(1011)$, compared to conventionally processed high purity cobalt. The inventors observed that in high purity cobalt which has received about 10% or greater cold deformation, there was no detectable fcc phase present in the material, in which case the intensity ratio, $I_{fcc}(200)/I_{hcp}(1011)$, becomes about zero. (Column 3 lines 32-50)

Intermediate anneals in the range 300-422.degree. C. were used to *stress relieve* (i.e. cold working will produce stress) and *recrystallize* the cobalt and allow additional cold working treatments to proceed without the material exceeding the ductility limit and fracturing. This intermediate annealing step is an integral part of the invention and allows substantial quantities of cold work to be imparted into the metal, and in so doing significantly reduces the amount of fcc cobalt in the final material. Table 1 shows the composition of the seven high purity cobalt samples used to illustrate invention. (Column 4 lines 11-16)

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Back that flux

The strength of the magnetic field leaked into the discharge space can be measured by PTF. FIG. 4 shows the PTF measurements associated with a conventional cobalt sputtering target (a) and a cobalt sputtering target according to this invention (b). (Column 4 lines 58-61)

The results, shown in Table 2, confirmed that the permeability in the plane of the conventional sample is multiples higher than it is in the samples of this invention. The permeability ratio, (z-direction/x-direction) is significantly increased with cold work treatment according to this invention. (Column 4 lines 62-68)

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abburi et al. (U.S. Pat. 6,086,725).

Abburi et al. is discussed above and all is as applies above. (See Abburi et al. discussed above)

The differences between Abburi et al. and the present claims is that the exact steps to achieve the claimed product is not disclosed, the exact range of texture is not discussed, selected boundary ranges is not discussed and the exact range of grain size is not discussed.

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As to the exact steps required by the claims in order to achieve the *claimed product*, it is pointed out that Abburi et al. teach that various alternative manufacturing processes can be utilized to achieve their required product and that their required product meets the product limitations required by Applicant's claims. (See Abburi et al. Column 12 lines 12-15)

(200) As to the exact range of texture required by Applicant's claims, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected the portion of the prior art's range which is in the range of applicant's claims because it has been held to be obvious to select a value in a known range by optimization for the best results, see In re Aller, et al., 105 U.S.P.Q. 233.

As to the boundary range required by Applicant's claims, it is believed that the target would inherently have a boundary range encompassing a test area where the fcc phase is present. (See Abstract)

grain size
As to the exact range of grain size required by Applicant's claims, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected the portion of the prior art's range which is in the range of applicant's claims because it has been held to be obvious to select a value in a known range by optimization for the best results, see In re Aller, et al., 105 U.S.P.Q. 233.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made have a target with specific properties as taught by Abburi et al. because it allows for increasing the pass through of a magnetic field.

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6. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cole et al. (U.S. Pat. 6,391,172).

Cole et al. is discussed above and all is as applies above. (See Cole et al. discussed above)

The differences between Cole et al. and the present claims is that inducing stress is not directly discussed and the specific reduction in cross-sectional area is not discussed.

Cole et al. teach that the cold working treatments induce stress to the target and heat treatments are needed to reduce some of the stress in order to do additional cold working steps which induce stress. (See Cole et al. Column 4 lines 11-17)

As to the specific reduction in cross-sectional area, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected the portion of the prior art's range (i.e. at least a reduction in thickness of about 10% or more) which is in the range of applicant's claims because it has been held to be obvious to select a value in a known range by optimization for the best results, see *In re Aller*, et al., 105 U.S.P.Q. 233.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a target with specific properties as taught by Cole et al. because it allows for increased permeability ratio, sputtering efficiency and material utilization.

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7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney McDonald whose telephone number is 703-308-3807. The examiner can normally be reached on M-Th from 8 to 5:30. The examiner can also be reached on alternate Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen, can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



RODNEY G. MCDONALD
PRIMARY EXAMINER

RM

February 5, 2003